

WERF Research Projects on Treatment and Management of Residuals and Biosolids

No.	Project Number and Project Title	Principal Investigator and Contracting Organization	Research Objectives	Project Cost (WERF & Total), Status of Project
Thirty Six (36) Completed Projects				
1	90-4, Innovative Process Assessment: Sludge Processing, Disposal, and Reuse	Richard Kuchenrither, Ph.D., P.E. Black & Veatch Kansas City, MO	Provides an assessment of diverse research/ development projects regarding the treatment and disposal of biosolids.	WERF: \$100,000, Total: \$100,000 Completed
2	91-ISP-1, Evaluating and Measuring Biosolids Incinerator Emissions (Product No. D93006)	John Stukenberg, Ph.D., P.E. Black & Veatch Kansas City, MO	Developed a database on incinerator emission characteristics; users determine performance evaluation for various airborne contaminant control options (including hydrocarbons).	WERF: \$619,375, Total: \$734,000 Completed
3	91-ISP-4, Document Long Term Experience of Biosolids Land Application Program s (Product No. D0015)	John R. Stukenberg, Ph.D. Black & Veatch Kansas City, MO	Provides information on the beneficial use of biosolids in land application programs.	WERF: \$75,000, Total: \$75,000 Completed
4	91-ISP-5, Polymer Characterization and Control in Biosolids Management (Product No. D43007)	Steven Dentel, Ph.D., P.E. University of Delaware Newark, DE	Provides information on optimal usage of chemical conditioners for biosolids dewatering. Assesses automatic polymer feed equipment. Provides a formal protocol for making decisions on selecting polymers and estimating dosing rates.	WERF: \$230,000, Total: \$299,000 Completed
5	91-ISP-5A, Guidance Manual for Polymer Selection in Wastewater Treatment Plants (Companion report to project above) (Product No. D0013)	Steven Dentel, Ph.D., P.E. University of Delaware Newark, DE	Aids wastewater chemists, managers, and operators in the selection of polymers. Systematic processes for polymer selection are divided into modules for each type of polymer application with step-by-step guidance.	Included in above project Completed
6	92-PUM-1C0, Long-Term Fate of Land Applied Wastewater Materials	New York State Energy Research and Development Authority (cooperative project)	A collaborative program project that examines the long term effects of land application of biosolids products and evaluates the effects of using various forms of materials on land sites, including compost, pelletized products and liquid applications.	WERF: \$0, Total: \$983,000
7	94-REM-1, Defining Biosolids Stability: A Basis for Public and Regulatory Acceptance (Product No. D72002)	Michael S. Switzenbaum, Ph.D. Univ. of Massachusetts Amherst, MA	Provides information on biosolids stability criteria and recommends definitions for stability for various biosolids processes and products.	Total: \$91,000 Completed

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8	94-REM-2, Analysis and Fate of Polymers in Wastewater Treatment (Product No. D00301)	Steven Dentel, Ph.D., P.E., DEE University of Delaware Newark, DE	Addresses the impact and fate of polymers used as flocculant agents in wastewater treatment. Evaluates when polymer release to the environment may be harmful. Examines analytical methods to detect polymer.	WERF: \$195,935, Total: \$269,150 Completed
9	95-REM-3, Understanding Fate, Transport, Bioavailability and Cycling of Metals (Molybdenum) in Land Applied Biosolids (Product No. D93017)	George O'Connor, Ph.D. University of Florida Gainesville, FL	Improves understanding of risks and the pathways associated with metal uptake (focusing on molybdenum) in grazing animals. Enhances scientific knowledge base and provides information relative to EPA's Part 503 regulations on molybdenum.	WERF: \$422,100, Total: \$573,600 Completed
10	96-CTS-5, Benchmarking Wastewater Treatment Plant Operations – Collection, Treatment, and Biosolids Management (Product No. D73001)	Roger Patrick Water Research Center (WRC)	Derives performance standards for wastewater treatment operators to help focus their efforts, improve operations, and reduce costs. Highlights approaches, processes, and results that have been used by others to accomplish these objectives.	WERF: \$293,500, Total: \$335,334 Completed
11	96-REM-1, Biosolids Management: Assessment of Innovative Processes (Product No. D83004)	Albert Pincince, Ph.D., P.E. Camp, Dresser & McKee Cambridge, MA	Identifies and reports on the development, status and cost effectiveness more than 110 innovative biosolids processing and management technologies.	Total: \$72,000 Completed
12	96-REM-2, Watershed Effects of Biosolids Land Application: Literature Review (Product No. D93003)	Kathryn Draeger Environmental Ground, Inc., St. Paul, MN	Assesses available information (more than 1400 references spanning 100 years) on the uses and impacts of biosolids in watersheds.	Total: \$98,000 Completed
13	97-REM-2, Pathogen Destruction Efficiency in High Temperature Digestion	Donald Gabb, Ph.D., P.E. East Bay Municipal Utility District Oakland, CA	Compiles information available worldwide on high temperature digestion studies. Will develop practical and economical high temperature (mesophilic/thermophilic) digestion protocols to yield Class A biosolids products and augment existing processes to further reduce pathogens.	WERF: \$285,826, Total: \$576,478 Completed
14	97-REM-3, Estimating Plant -Available Nitrogen in Biosolids (Product No. D00307)	John Gilmour, Ph.D. University of Arkansas Fayetteville, AR	Practical guidance for biosolids managers and regulatory agencies in using biosolids to benefit crop growth, and in minimizing the potential for nitrogen to migrate to groundwater or cause surface water pollution.	WERF: \$100,000, Total: \$235,458 Completed

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15	97-REM-4, Investigating the Effects of Electrical Arc Pretreatment of Biosolids (Product No. D00314)	Steven Dentel, Ph.D., P.E., DEE University of Delaware Newark, DE	Investigates the feasibility of electrical arc pretreatment of biosolids as a potential innovative biosolids dewatering process prior to chemical conditioning and dewatering. Addresses fundamental and applied aspects of its operation.	WERF: \$148,173, Total: \$200,462 Completed
16	97-REM-5, Assessing Bioavailability of Metals in Biosolid-Amended Soils: Root Exudates and their Effects on Solubility of Metals	Andrew Chang, Ph.D., P.E. University of California, Riverside Riverside, CA	Exploring phenomena that control the fate of metals in biosolids and soil mixtures, and impacts on ecological and human health. Will improve technical basis of 503 Rule, thereby enhancing its acceptability within the scientific community and improving public confidence.	WERF: \$247,634, Total: \$413,634 Completed
17	98-CTS-2, Use of Novel Techniques to Quantify Phenotypes in Biological Treatment Processes	Kevin G. Robinson, Ph.D. University of Tennessee, Knoxville, TN	Will use novel techniques to identify specific phenotypes, and have relevance to municipal and industrial wastewater treatment as well as the treatment of biosolids.	WERF: \$383,414, Total: \$562,797 Completed
18	98-REM-1 (Phase 1), A Dynamic Model to Assess Microbial Health Risks Associated with Beneficial Uses of Biosolids	Jack Colford, M.D., Ph.D. University of California, Berkeley	The first phase developed an assessment framework for microbial exposures associated with beneficial biosolids reuse, and a streamlined protocol to assess risks from various exposure pathways.	WERF: \$310,052, Total: \$360,326 Completed
19	99-PUM-1, Evaluating Risks and Benefits of Soil Amendments Used in Agriculture	Lynne H. Moss, P.E. Camp, Dresser, & McKee Austin, TX	Determines the risks and benefits, advantages and potential disadvantages associated with the use of a variety of soil amendments in comparison to chemical fertilizers. Provides information in determining which soil amendment can be used in or for a specific soil, crop, or climatic condition.	WERF: \$183,553, Total: \$205,631 Completed
20	99-PUM-2T, Characterizing the Forms, Solubilities, Bioavailabilities and Mineralization Rates of Phosphorus in Biosolids, Commercial Fertilizers and Animal Manures (Phase 1) (PDF available)	George O'Connor, Ph.D. University of Florida Gainesville, FL	Phase I characterized the forms and solubilities of phosphorus in a variety of biosolids products and in biosolids-soils matrices. Phase II will further define this work	WERF: \$495,643, Total: \$611,935 Completed
21	99-PUM-3, Developing Protocols for Measuring Biosolids Stability	Michael S. Switzenbaum, Ph.D. Univ. of Massachusetts Amherst, MA	Develops standard, detailed protocols for conducting tests that are commonly used to assess stability in the associated biosolids/products.	WERF: \$145,000, Total: \$221,097 Completed

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22	99-PUM-5T, Manual of Good Practice for Biosolids (Product available from the NBP website: http://biosolids.policy.net/emsguide/manual/goodpractmanual.vtml))	Mark Lang, P.E. Sear Brown Group Rochester, NY	A targeted collaborative project that developed an online resource document on the issues to be considered when designing and implementing a biosolids management program. [Managed by WERF for the National Biosolids Partnership.]	NBP: \$179,941, Total: \$237,330 Completed
23	99-PUM-6-ET, Evaluating the Use of Near-Infrared Spectroscopy for the Analysis of Biosolids Constituents (Product No. D00306)	Diane F. Malley, Ph.D. PDK Projects, Canada	An emerging technology project that evaluated the feasibility of applying near-infrared spectroscopy (NIRS), widely used in commercial and industrial applications, to analyze nutrient and heavy metal concentrations in biosolids and receiving soils.	WERF: \$31,310, Total: \$41,168 Completed
24	98-REM-3, Thickening and Dewatering Processes: How to Evaluate and Implement an Automation Package (Product No. D13006)	Robert Gillette, P.E., DEE Carollo Engineers	Evaluates state of current practices, screens and field tests selected automation processes. Provides information to improve dewatering operations to cut the cost of dewatering biosolids in POTWs and in downstream operations.	WERF: \$274,998, Total: \$754,901 Completed
25	00-CTS-8, Membrane Technology: Feasibility of Solid/Liquid Separation in Wastewater Treatment	Glen Daigger, Ph.D., P.E. CH2M-Hill	Provides a comprehensive assessment of membrane applications and identifies a method to evaluate the use of membrane technologies for specific treatment applications. Results from this research will allow for a direct comparison of membrane technologies with more conventional methods of solid/liquid separation.	WERF: \$125,000, Total: \$434,674 Completed
26	00-CTS-10T, Minimizing Biomass Production from Biological Treatment	David H. Stensel, Ph.D., P.E. University of Washington Seattle	Will identify and evaluate methods to reduce biological solids in aerated biological reactors. It will determine whether cost savings can practically be realized by reducing the ultimate amount of waste requiring treatment and disposal.	WERF: \$180,000, Total: \$282,938 Completed
27	00-HHE-5T (Phase I) Identifying and Controlling Municipal Wastewater Odor Environment – Literature Review	Gregory M. Adams, P.E. Los Angeles County Sanitation District, and Jay Witherspoon, Ph.D., P.E. CH2M-Hill	The primary objective is to evaluate the state of knowledge and science about odors and odor control for all stages of treatment and disposal of wastewater and residuals. It provides a basis from which to begin a multi-phase process to develop efficient, effective odor control technologies at all stages of wastewater treatment and disposal. Phase 1 involves critical reviews and syntheses of published information (includes conventional and grey literature), findings from recent and upcoming odors-related workshops, as well as electronic databases.	WERF: \$498,000, Total: \$1,525,000 (for all phases and addendum) Completed

No.	Project Number and Project Title	Principal Investigator and Contracting Organization	Research Objectives	Project Cost (WERF & Total), Status of Project
28	00-HHE-5T (Phase II), Identifying and Controlling Odor in the Municipal Wastewater Environment Phase II: Impacts of In-Plant Parameters on Biosolids Odor Quality	Gregory M. Adams, P.E. Los Angeles County Sanitation District, and Jay Witherspoon, Ph.D., P.E. CH2M-Hill	Phase 2 will collect objective data to demonstrate the influence of anaerobic digestion system design and operating parameters on the odor quality of the final product. Biosolids odor emissions will be measured before and after anaerobic digestion and operations and treatment parameters will be measured to determine the influence of these parameters on biosolids odor quality. A total of 10 POTWS are involved in the Phase 2 research effort.	See above Completed
29	00-HHE-5T (HEA), Identifying and Controlling Municipal Wastewater Odor Environment – Health Effects Addendum	William Cain, Ph.D. Gregory M. Adams, P.E. Los Angeles County Sanitation District, and Jay Witherspoon, Ph.D., P.E. CH2M-Hill	The overall objective was to identify the research gaps and needs through a review of appropriate literature and to prioritize the future direction of research on health effects associated with POTW biosolids odors.	See above Completed
30	00-PUM-5, Biosolids: Understanding Public Perception and Participation	Ned Beecher New England Biosolids & Residuals Association, Tamworth, NH	Lessons learned from successful and unsuccessful biosolids recycling programs will be shared to provide guidance in incorporating stakeholder priorities.	WERF: \$148,850, Total: \$169,950 Completed
31	00-PUM-7, Development of a Cost Determination Protocol for Use in Benchmarking Biosolids Management Programs	Eliot Epstein, Ph.D. E&A Environmental Consultants, Inc.	Developed a protocol to identify and quantify direct and indirect costs associated with management of biosolids for all reuse and disposal options. The protocol was tested and refined at several sites that represent wide range of biosolids management options in diverse geographic areas. Should help utility managers evaluate the cost of biosolids management programs on a consistent basis with other agencies.	WERF: \$100,000, Total: \$100,000 Completed
32	01-CTS-32-ET, A New Tool for Measuring Biosolids Floc Strength	Mohammad Abu-Orf, Ph.D. US Filter NATC / Vivendi Water	Established a standard method and set of procedures for measuring floc strength. Will aid in understanding fundamentals of conditioning and enhance full scale dewatering	WERF: \$49,342, Total: \$104,342 Completed
33	02-CTS-8-P Advanced Biosolids Flow-Through Thermophilic Treatment (BFT3) Demonstration Project	Billy Turner and Cliff Arnett Columbus Water Works, GA John Willis, Brown & Caldwell Mike Aitken & Mark Sobsey, University of North Carolina – Chapel Hill	Evaluated the BFT3 process for retrofitting existing digestion systems to upgrade them from Class B to Class A. WERF provided peer review of the protocols definition, experimental testing for health risk assessment of microbial contaminants, and full-scale start-up.	WERF Peer Review: \$28,000 Total Project: >\$1 M Completed

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34	02-HHE-1-CO, Analytical Method for Endocrine Disruptors in Sewage Sludge	Cooperative Project with UKWIR Contractor: WRc	Will solidify methods for extracting steroidal hormones from biosolids.	WERF: \$45,000 Total: \$90,000 Completed
35	03-HHE-1, WERF/EPA Biosolids Research Summit	WERF & Consensus Building Institute	Multi-stakeholder workshop that developed a research agenda to address scientific issues related to the land application of biosolids.	WERF: \$100,000, Total: \$125,000 Completed
36	95-REM-2 Producing Class A Biosolids with Low - Cost, Low-Technology Treatment Processes	Perry Schafer, P.E., DEE Brown and Caldwell	Class A biosolids have been and are now being produced by low-cost, low-technology biosolids treatment processes including lagoon storage, air drying, and cake storage. This project reviewed the available literature and municipal agency data about these processes.	WERF: \$214,000, Total: \$439,000 Completed
<i>Fifteen (15) Ongoing Projects</i>				
37	98-REM-1A (Phase II), A Dynamic Model to Assess Microbial Health Risks Associated with Beneficial Uses of Biosolids	Joe Eisenberg, Ph.D. University of California, Berkeley	The second phase will apply the framework developed in Phase I to characterize risk associated with real-world biosolid application scenarios.	WERF: \$260,000, Total: \$260,000 Ongoing
38	99-HHE-3, Control of Human Parasites in Municipal Biosolids	Christine L. Bean University of New Hampshire Durham, NH	Screens, identifies, and selects an appropriate surrogate human parasite(s), in lieu of helminth ova, and develops protocols to recover, detect, and measure surrogate organism(s) for municipal wastewater biosolids.	WERF: \$299,640, Total: \$376,046 Ongoing
39	99-PUM-2T (Phase II), Characterizing the Forms, Solubilities, Bioavailabilities and Mineralization Rates of Phosphorus in Biosolids, Commercial Fertilizers and Animal Manures	George O'Connor, Ph.D. University of Florida Gainesville, FL	Phase II research will confirm and expand Phase I findings on the fate of phosphorus added to soil from biosolids and manures and will improve our ability to use these amendments for environmentally sound crop production.	WERF: \$300,000, Total: \$300,000 Ongoing
40	00-PUM-6, A Safety Assessment Tool for Land Application of Biosolids	Katherine M. Banks, Ph.D. Purdue University	Will develop a series of toxicity bioassay tests that will provide practitioners with a way to address citizen concerns regarding the human health and environmental impacts of biosolids reuse.	WERF: \$250,000, Total: \$250,000 In Production

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41	01-CTS-1, Mechanisms of Conditioning, Thickening and Dewatering	Matthew J. Higgins, Ph.D. Bucknell University	Will improve understanding of the nature of flocs and the specific chemical interactions that alter floc properties. Results could lead to better selection of conditioning chemicals, help to reduce chemical costs and/or lead to improved dewatering techniques.	WERF: \$224,340, Total: \$234,340 In Production
42	01-CTS-18-UR, Cost-Effective Energy Recovery From Anaerobically Treated Wastewater Solids	Hugh Monteith, Ph.D. Enviromega, Inc.	Will identify cost-effective alternatives for energy recovery from solids treatment (anaerobic) based on key factors such as energy costs, regulatory conditions, plant capacity, social values, and more.	WERF: \$173,959, Total: \$224,259 Ongoing
43	01-CTS-19-UR, Effects of Biosolids Properties on Membrane Bioreactors (MBRs) and Solids Processing	Slav Hermanowicz, Ph.D., P.E. University of California Berkeley	Will investigate the effects of biosolids characteristics on membrane performance and solids processing. This will help define the operating limits of MBRs in municipal wastewater treatment and improve understanding of the behavior of solids to be processed.	WERF: \$199,978, Total: \$384,476 Ongoing
44	01-HHE-3, Assessing the Fate of Emerging Pathogens in Biosolids	Scott Yates, Ph.D. University of California-Riverside	Will detect and follow the fate of emerging pathogens in biosolids from the treatment process through land application until they are undetectable. Will help address public health concerns regarding land application of biosolids.	WERF: \$399,982 Total: \$978,557 Ongoing
45	02-CTS-3, Innovative Technologies to Reduce Water Content of Dewatered Sludges	Sarah Miller CSIRO Manufacturing & Infrastructure Technology	Will evaluate methods to improve water removal from dewatered cakes, including innovative equipment, new additives, additive or conditioning agent combinations, physical modifications, or a combination of these or other approaches.	WERF: \$250,000, Total: \$ 292,864 Ongoing
46	02-HHE-2, Biosolids Sample Processing for Analyses of Pathogens	Morteza Abbaszadegan, PhD Arizona State University	Will develop sample preparation methods for use with molecular detection techniques such as microarray analysis, quantitative PCR, fiber-optic biosensors, and other new technologies. Will help address public concern over land-applied biosolids by measuring the presence and fate of pathogens.	WERF: \$200,000, Total: \$200,000 Ongoing
47	02-PUM-1, Quantification of Airborne Biological Contaminants Associated with Land Applied Biosolids	Jordan Peccia, PhD Arizona State University	Will provide fundamental data to assess the potential release and exposure to agents from land application of Class B biosolids. Will review current health-impact literature and provide quantitative data on biosolids.	WERF: \$200,000, Total: \$ 309,724 Ongoing

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48	03-CTS-9, Biosolids Processing Modifications for Cake Odor Reduction	Gregory M. Adams, P.E. Los Angeles County Sanitation District, and Jay Witherspoon, Ph.D., P.E. CH2M-Hill	Will build on and enhance an existing process, anaerobic biosolids digestion, to produce lower-odor biosolids. Equipment or process vendors may be invited to demonstrate their processes full-scale at one or two plants, while researchers collect and analyze data and compares results. Builds upon work conducted in Identifying and Controlling Municipal Wastewater Odors (00-HHE-5T).	WERF: \$300,000, Total: \$ 1,251,500 Ongoing
49	03-CTS-13T, Examination of Reactivation of Fecal Coliforms in Anaerobically Digested Biosolids	Matthew J. Higgins, PhD Bucknell University	Will look at the phenomenon of reactivation of pathogens through the digestion process. Will demonstrate that pathogens exist in a viable-but-non-culturable state through the digestion process but are induced to become culturable due to the presence of a substrate in the dewatering process, which allows for rapid growth in the final cake material. This work will complement WERF project 02-CTS-2.	WERF: \$150,000, Total: \$164,215 Ongoing
50	03-HHE-2, Developing Better Indicators of Pathogen Risk in Waste Matrices	Judy Blackbeard CRC Water Quality and Treatment Australia	Will compare the accuracy, advantages, and disadvantages of existing indicator organisms with proposed indicators in wastewater, stormwater, and biosolids.	WERF \$325,000, Total: \$TBD Ongoing
51	04-CTS -3T, Fecal and Pathogen Regrowth/Reactivation From Centrifugation of Anaerobically Digested Sludges	Matthew J. Higgins, PhD Bucknell University	Will examine the extent that organisms may be entering the VNC state during digestion and the conditions that cause their reactivation.	WERF \$ 140,000 Total Ongoing
Five (5) New Projects				
52	03-HHE-5PP, Methodology for Implementing a Rapid Incident Response Mechanism	TBD	The first step in this project will be to convene a workshop of diverse stakeholders who will provide input into a scope of work that will address institutional arrangements and scientific protocols needed to develop a rapid response network to respond to claims of adverse health effects from biosolids land application sites.	WERF \$200,000 Total: \$TBD RFP in Development

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53	04-CTS-2, Cost/Benefit Analysis of Management Options for Sludge/Biosolids	TBD	Will develop a method for evaluating the costs and benefits of various sludge/biosolids disposal and beneficial use options that provides utility and industry managers with the information necessary to make a decision on which option to use. This information can also be shared with the general public to help explain the disposal or beneficial use options made by the utilities.	WERF \$250,000 Total: TBD Under Contract Negotiation
54	04-CTS-7, Minimizing Mercury Emissions from Biosolids Incinerators	TBD	Will quantify mercury emissions from representative biosolids incinerators located in the United States. Will establish test protocols that POTWs that practice incineration can use to accurately determine the fate of the mercury that enters their plants. Will identify practices and control technologies to cost-effectively reduce mercury emissions from biosolids incinerators.	WERF \$50,000 Total: TBD Under Contract Negotiation
55	04-HHE-6, Fate of Estrogenic Compounds During Municipal Sludge Stabilization and Dewatering	TBD	Will investigate the fate of known estrogenic compounds and total estrogenic activity in solids derived from wastewater treatment, in processes commonly used to stabilize, disinfect and dewater municipal wastewater treatment sludges.	WERF \$250,000 Total: TBD Under Contract Negotiation
56	04-HHE-7, Standardized Methods for Sampling Microorganisms in Biosolids	TBD	Will develop scientifically defensible methods for collecting and handling representative samples for microbial analysis from biosolids matrices with the greatest potential impact to public health (liquid, cake, compost).	WERF \$300,000 Total: TBD Under Contract Negotiation

Information current as of June 23, 2005

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